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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/728,775	12/08/2003	Sung-Kwon Lee	P69355US0	2372
43569	7590	04/18/2005	EXAMINER	
MAYER, BROWN, ROWE & MAW LLP 1909 K STREET, N.W. WASHINGTON, DC 20006			NGUYEN, THANH T	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 04/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No.		Applicant(s)	
	10/728,775		LEE ET AL.	
	Examiner		Art Unit	
	Thanh T. Nguyen		2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 January 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 5-19, 21-28 and 30-35 is/are rejected.
- 7) ☒ Claim(s) 4, 20 and 29 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-35 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 11, 13-16, 34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The limitation "if" in claims 11, 13-15 render the claims indefinite because the term "if" has a degree of uncertainty. It is suggested to delete "if".

The limitation "an anti-reflective coating layer is formed on between the hard mask insulation layer and the hard mask sacrificial layer" in claim 34, render the claim indefinite because it is know that antireflective is form beneath the photoresist layer. It is suggested to change to limitation "an anti-reflective coating layer is formed on between the photoresist and the hard mask sacrificial layer".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 6-10, 13, 18, 22-23, 26, 28, 30-34 are rejected under 35 U.S.C. 102(e) as being anticipated by Blosser. (U.S. Patent No. 6,682,996).

Referring to figures 1-10, Blosser teaches a method for fabricating a semiconductor device, comprising the steps of:

Forming a hard mask insulation layer (34) on an etch target layer (28/30);

Forming a hard mask sacrificial layer (36) on the hard mask insulation layer;

Forming an anti-reflective coating layer (38) on the hard mask sacrificial layer (meeting claims 18, 34)

Coating a photoresist (40) on the hard mask insulation layer (see figures 3);

Selectively performing a photo-exposure process and a developing process to form a photoresist pattern having a first width for forming a line pattern (see figure 3);

Etching the anti-reflective coating layer (see figure 4) by using the photoresist pattern as an etch mask (meeting claim 18);

Selectively etching the hard mask sacrificial layer by using the photoresist pattern as an etch mask to form a sacrificial hard mask having a second width (see figure 5);

Removing the photoresist pattern and the antireflective coating layer (see figure 6, meeting claim 18);

Etching the hard mask insulation layer by controlling excessive etching conditions with use of the sacrificial hard mask as an etch mask to form a hard mask having a third width (see figure 7); and

Etching the etch target layer (30/28) by using the sacrificial hard mask and the hard mask as an etch mask to form the line pattern having a fourth width (see figure 8), wherein the first width (see figure 3) is wider than the fourth width (see figure 8). Noted that the second/third/fourth can have the same width.

Regarding to claims 2, 28, etch target layer is a conductive layer (tungsten) and the line pattern is one of a bit line, a word line and a metal line (see col. 7, lines 36-66).

Regarding to claims 3, 19, 27, photoresist is use one of ArF or F₂ photolithography (see col. 14, lines 42-54).

Regarding to claims 6, 30, the sacrificial hard mask is removed at the step of removing etch target (conductive) layer (see figure 8-9, col. 13, lines 36-53).

Regarding to claim 7-8, 10, 22, 31-32, hard mask sacrificial layer (tungsten, see col. 10, lines 4-20).

Regarding to claims 9, 33, the hard mask insulation layer (called cap layer) is formed with one of an oxide-based material (see col. 8, lines 31-34)

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Regarding to claim 13, etching the hard mask sacrificial layer polysilicon by using chlorine based gas (see col. 12, lines 8-25).

Regarding to claim 23, anti-reflective layer is organic material (see col. 10, lines 50-51).

Regarding to claim 34, anti-reflective coating formed on between the sacrificial layer and the photoresist layer (see figure 3), noted that this rejection is based on 112 rejection above.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 5, 11-12, 17, 19, 21, 24-25, 27, 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blosser. (U.S. Patent No. 6,682,996) as applied to claims 1-2, 6-10, 13, 18, 22-23, 26, 28, 30-34 above in view of Ohuchi et al. (U.S. Patent No. 6,576,562), Nallan et al. (U.S. Patent No. 6,440,870) and Chen et al. (U.S. Patent Publication No. 2004/0129361).

Blosser teaches a method for fabricating a semiconductor device, comprising the steps of:

Forming a hard mask insulation layer (34) on an etch target layer (28/30);

Forming a hard mask sacrificial layer (36) on the hard mask insulation layer;

Forming an anti-reflective coating layer (38) on the hard mask sacrificial layer (meeting claims 18, 34)

Coating a photoresist (40) on the hard mask insulation layer (see figures 3);

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Selectively performing a photo-exposure process and a developing process to form a photoresist pattern having a first width for forming a line pattern (see figure 3);

Etching the anti-reflective coating layer (see figure 4) by using the photoresist pattern as an etch mask (meeting claim 18);

Selectively etching the hard mask sacrificial layer by using the photoresist pattern as an etch mask to form a sacrificial hard mask having a second width (see figure 5);

Removing the photoresist pattern and the antireflective coating layer (see figure 6, meeting claim 18);

Etching the hard mask insulation layer by controlling excessive etching conditions with use of the sacrificial hard mask as an etch mask to form a hard mask having a third width (see figure 7); and

Etching the etch target layer (30/28) by using the sacrificial hard mask and the hard mask as an etch mask to form the line pattern having a fourth width (see figure 8), wherein the first width (see figure 3) is wider than the fourth width (see figure 8). Noted that the second/third/fourth can have the same width.

However, the reference does not forming a photoresist pattern by using ArF or F₂ photolithography, etching the tungsten layer by using a plasma containing a mixed gas of SF₆ and N₂ etching the antireflective coating by using plasma containing mixed gas of Cl₂ and Ar

Ohuchi et al. teaches forming a photoresist pattern by using ArF or F₂ photolithography (see col. 14, lines 42-54, meeting claim 4, 27)

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form a photoresist pattern by using ArF or F₂

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photolithography in process of Chan or Huang et al. because the process is known in developing photoresist pattern.

Nallan et al. teaches, regarding to claims 11, 17, 35, etching the tungsten layer by using a plasma containing a mixed gas of SF₆ and N₂ (abstract).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would etching the tungsten layer using a plasma containing a mixed gas of SF₆ and N₂ in process of Chan or Huang et al. because the process would provide a better control etching profile of the tungsten layer.

Chen et al. teaches regarding to claim 24, etching the antireflective coating by using plasma containing mixed gas of Cl₂ and Ar (see paragraph#25).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would etch the antireflective coating by using plasma containing mixed gas of Cl₂ and Ar in process of Blosser et al. as taught by Chen et al. because the process would provide high etch selectivity.

The width range, power range, pressure range, and flowrate range are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious:

ANormally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed Acritical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.≡

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In re Aller 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any width range, power range, pressure range, and flowrate range suitable to the method in process of Blosser et al. in order to optimize the process.

Allowable Subject Matter

Claims 4, 20, 29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).

A handwritten signature in black ink, appearing to read 'Thanh', with a long, sweeping horizontal stroke extending to the left.

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800